

New Hampshire Volunteer Lake Assessment Program

2002 Interim Report for Powwow Pond East Kingston



NHDES
Water Division
Watershed Management Bureau
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OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **POWWOW POND**, the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the pond has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a and are naturally found in lake ecosystems, the chlorophyll-a concentration found in the water gives an estimation of the concentration of algae or lake productivity. The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 ug/L.

Similar to the summer of 2001, the summer of 2002 was filled with many warm and sunny days and there was a lower than normal amount of rainfall during the latter-half of the summer. The combination of these factors resulted in relatively warm surface waters throughout the state. The lack of fresh water to the lakes/ponds reduced the rate of flushing which may have resulted in water stagnation. Due to these conditions, many lakes and ponds experienced increased algae growth, including filamentous green algae (the billowy clouds of green algae typically seen floating near shore), and some lakes/ponds experienced nuisance cyanobacteria (blue-green algae) blooms.

The current year data (the top graph) shows that the chlorophyll-a concentration **increased** from May to September this season.

The historical data (the bottom graph) show that the 2002 chlorophyll-a mean is **less than** the state mean. Overall, visual inspection of the historical data trend line (the bottom graph) shows **a variable** in-lake chlorophyll-a trend, meaning that the concentration

has ***fluctuated*** since monitoring began. It is also worthy to note that the chlorophyll-a concentration has ***decreased*** since 2000.

After at least 10 consecutive years of sample collection for the pond, we will conduct a statistical analysis of the data. This will allow us to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Therefore, algal concentrations may increase when there is an increase in nonpoint sources of nutrient loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). It is important to continually educate residents about how activities within the watershed can affect phosphorus loading and lake quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for pond transparency. Table 3 lists the maximum, minimum and mean transparency data for each sampling season that the pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.

Two different weather related patterns occurred this past spring and summer that influenced lake quality during the summer season.

In late May and early June of 2002, numerous rainstorms occurred. Stormwater runoff associated with these rainstorms may have increased phosphorus loading, and the amount of soil particles washed into waterbodies throughout the state. Some lakes and ponds experienced lower than typical transparency readings during late May and early June.

However, similar to the 2001 sampling season, the lower than average amount of rainfall and the warmer temperatures during the latter-half of the summer resulted in a few lakes/ponds reporting their best-ever Secchi-disk readings in July and August (a time when we often observe reduced clarity due to increased algal growth)!

Overall, visual inspection of the historical data trend line (the bottom graph) shows **a slightly decreasing** trend for in-lake transparency, meaning that the transparency has **slightly worsened** since monitoring began in 1999.

Again, after at least 10 consecutive years of sample collection for the pond, we will conduct a statistical analysis of the data. This will allow us to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into the pond and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants are available from NHDES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a pond can lead to increases in plant and algal growth over time. The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.

The historical data for the epilimnion (upper layer) and the hypolimnion (lower layer) show that the 2002 total phosphorus mean is **greater than** the state median.

It is important to note that the total phosphorus concentration in the hypolimnion was elevated on the **September 16th** sampling event. In addition, the turbidity of the hypolimnion (lower layer) sample was also elevated. This suggests that the pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling. When the pond bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting the hypolimnion sample, please check to make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

Overall, visual inspection of the historical data trend line for the epilimnion and the hypolimnion shows **an increasing** total phosphorus trend. Specifically, this means that the concentration has **worsened** in the epilimnion and the hypolimnion since monitoring began in 1999.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands. If you would like to educate watershed residents about how they can help to reduce phosphorus loading into the pond, please contact the VLAP Coordinator.

TABLE INTERPRETATION

➤ **Table 2: Phytoplankton**

Small amounts of the cyanobacteria ***Microcystis***, ***Gleocapsa***, ***Oscillatoria***, and ***Spirulina*** were observed in the plankton sample this season. ***If present in large amounts, Microcystis and Oscillatoria, species can be toxic to livestock, wildlife, pets, and humans*** (Refer to page 14 of the "Biological Monitoring Parameters" section of this report for a more detailed explanation). Cyanobacteria can reach nuisance levels when excessive nutrients and favorable environmental conditions occur.

As with the summer of 2001, we observed that some lakes and ponds had cyanobacteria present during the 2002 summer season, likely due to the many warm and sunny days that occurred this summer, which may have accelerated algal and bacterial growth. In addition, the lower than normal amount of rainfall during the latter half of the summer, meant that the slow flushing rates resulted in less phosphorus exiting the pond outlet and more phosphorus being available for plankton growth.

The presence of cyanobacteria serves as a reminder of the pond's delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading into the pond by eliminating fertilizer use on lawns, keeping the pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the pond in September and October during the time of fall turnover (lake mixing) to document any blooms that may occur. Cyanobacteria have the ability to

regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to “pile” cyanobacteria into "surface scums" that accumulate in one section of the pond. If a fall bloom occurs, please contact the VLAP Coordinator.

➤ **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire’s lakes and ponds is 6.5, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to page 16 of the “Chemical Monitoring Parameters” section of this report.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake/pond pH.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 in Appendix B presents the current year and historic epilimnetic ANC for each year the pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the pond. For a more detailed explanation, please refer to page 16 of the “Chemical Monitoring Parameters” section of this report.

➤ **Table 6: Conductivity**

Table 6 in Appendix B presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. For a more detailed explanation, please refer to page 16 of the “Chemical Monitoring Parameters” section of this report.

➤ **Table 8: Total Phosphorus**

Table 8 in Appendix B presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is

the nutrient that limits the algae's ability to grow and reproduce. Please refer to page 17 of the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

➤ **Table 9 and 10: Dissolved Oxygen and Temperature Profile Data**

Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) for the 2002 sampling season. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

Dissolved oxygen was **high** at all depths sampled at the deep spot of the pond. Typically, shallow lakes and ponds that are not deep enough to stratify into more than one or two layers will have relatively high amounts of oxygen at all depths. This is due to continual lake mixing and diffusion of oxygen into the bottom waters induced by wind and wave action.

➤ **Table 11: Turbidity**

Table 11 in Appendix B lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to page 19 of the "Other Monitoring Parameters" section of this report for a more detailed explanation.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your pond, the biologist conducted a "Sampling Procedures Assessment Audit" for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled out an assessment audit sheet to document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor's Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors are not following the proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual pond and tributary conditions.

Overall, your monitoring group did an **excellent** job collecting samples on the annual biologist visit this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an **excellent** job when collecting samples and submitting them to the laboratory this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

NOTES

- **Monitor's Note (5/20/02):** 1 blue heron and several ducks were observed in Rowell Cove.
- **Monitor's Note (6/17/02):** Rainfall late Sunday afternoon and early evening. Rain and showers several days previous. Several ducks, 1 beaver and a pair of painted turtles were all observed in Rowell Cove. A beaver dam was observed in Bakie Brook, and water was flowing well over the dam.
- **Monitor's Note (9/16/02):** Bakie Brook was not sampled – no flow at road crossing. It rained (heavily at times) from Sunday evening to about 7 am Monday.

USEFUL RESOURCES

Changes to the Comprehensive Shoreland Protection Act: 2001 Legislative Session, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/sp/sp-8.htm

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/wmb/wmb-10.htm

The Lake Pocket Book. Prepared by The Terrene Institute, 2000. (internet: www.terrene.org, phone 800-726-4853)

Managing Lakes and Reservoirs, Third Edition, 2001. Prepared by the North American Lake Management Society (NALMS) and the Terrene Institute in cooperation with the U.S. Environmental Protection Agency. Copies are available from NALMS (internet: www.nalms.org, phone 608-233-2836), and the Terrene Institute (internet: www.terrene.org, phone 800-726-4853)

Organizing Lake Users: A Practical Guide. Written by Gretchen Flock, Judith Taggart, and Harvey Olem. Copies are available from the Terrene Institute (internet: www.terrene.org, phone 800-726-4853)

Proper Lawn Care in the Protected Shoreland: The Comprehensive Shoreland Protection Act, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-2.htm

Sand Dumping - Beach Construction, WD-BB-15, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-15.htm

Swimmers Itch, WD-BB-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-2.htm

Use of Lakes or Streams for Domestic Water Supply, WD-WSEB-1-11, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/ws/ws-1-11.htm

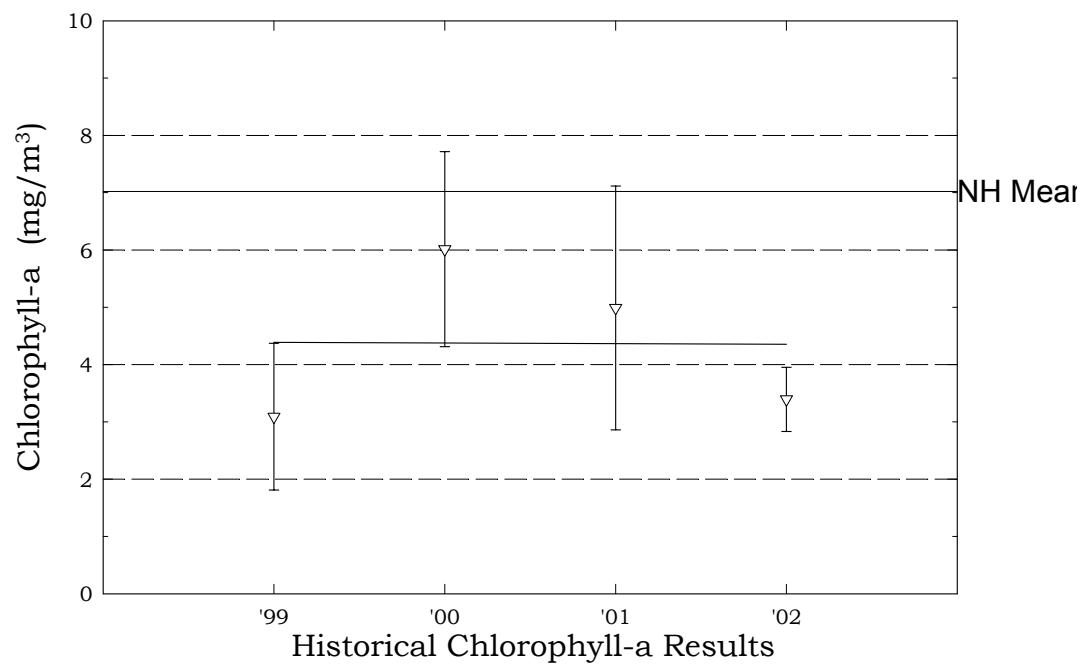
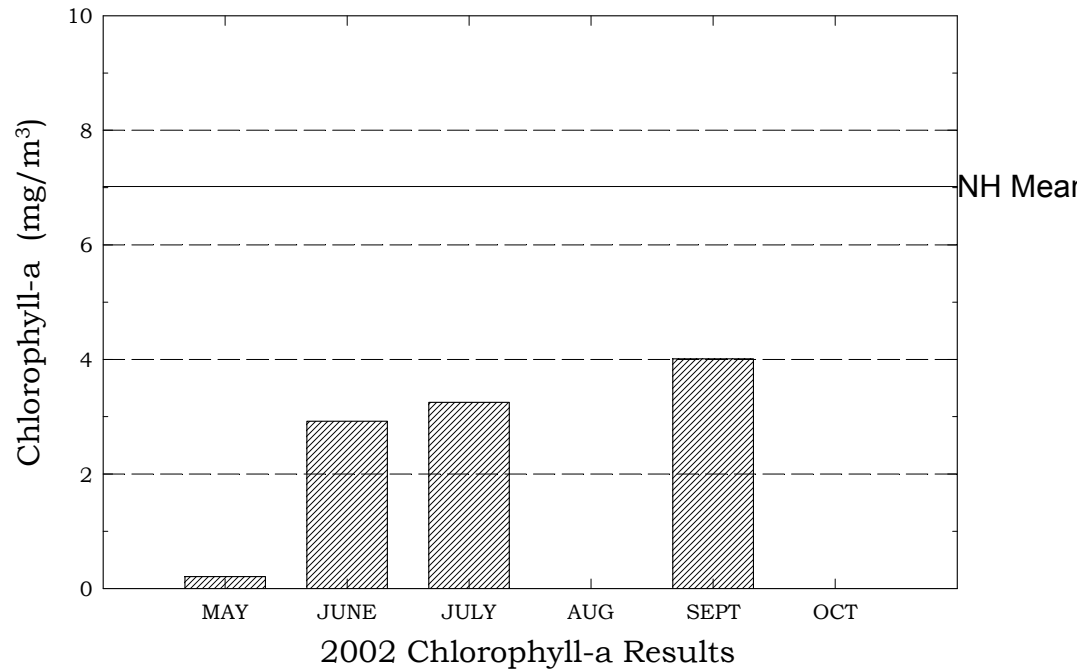
Water Milfoil, WD-BB-1, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-1.htm

Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-4.htm

Appendix A: Graphs

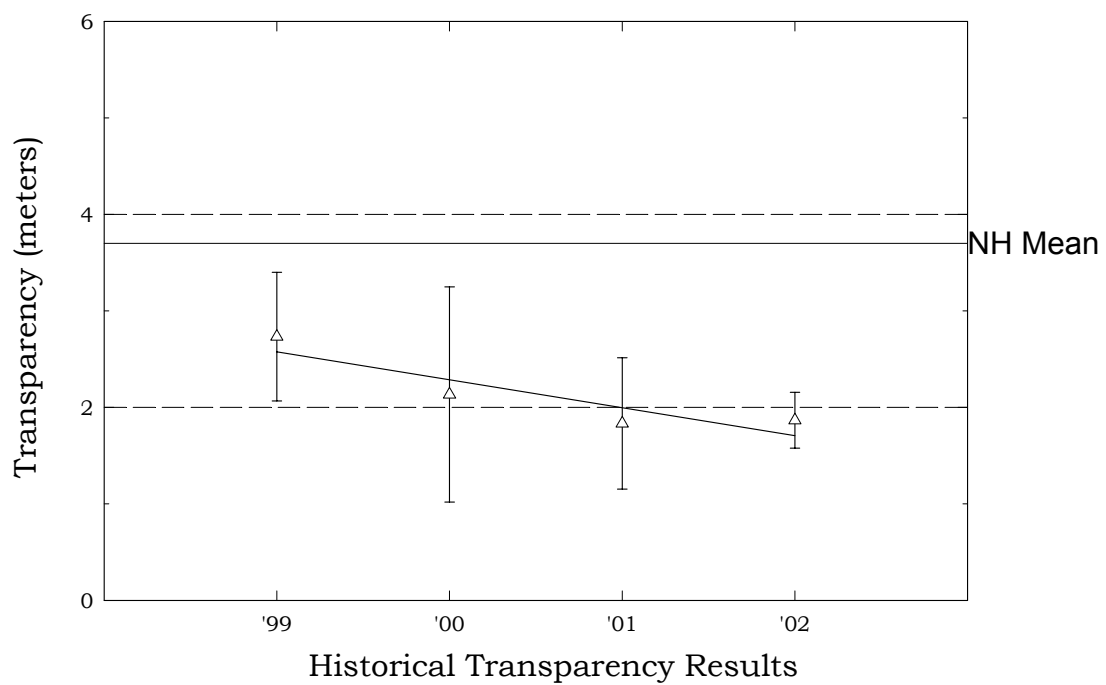
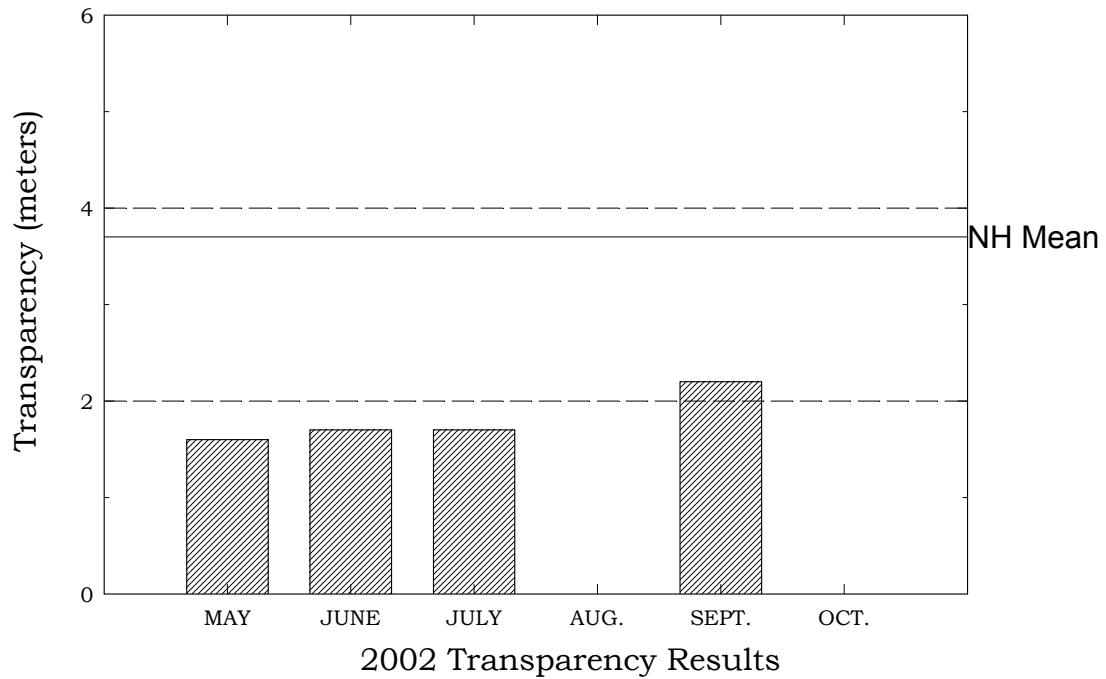
Powwow Pond, East Kingston

Figure 1. Monthly and Historical Chlorophyll-a Results



Powwow Pond, East Kingston

Figure 2. Monthly and Historical Transparency Results



Powwow Pond, East Kingston

Figure 3. Monthly and Historical Total Phosphorus Data.

